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The Two Koreas and the International Missile Trade

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Introduction

An increasing number of developing countries are missile-capable due to their independent development of a space booster rocket capability. Many others have a long run missile option in train due to their burgeoning modernization and industrialization. The diffusion of rocket technology is unstoppable in this regard and the world will be forced to turn to mixes of incentives and sanctions to ensure that ploughshares are not beaten into swords.[2]

Divided Korea is a unique example of this set of issues. The situation in Korea (including Korean missile activities) is peculiarly influenced by the continuing division of the Korean nation. No other current or likely missile-making or exporting state exhibits the same degree of political-military volatility nor lethal competition. Conversely, the cultural similarities, common history, and geopolitical contiguity of the two Koreas highlight domestic political-economic and institutional factors which help to explain why the two Koreas' missile strategies have diverged.

This study first examines the missile-related capabilities of both Koreas. It also emphasizes the role of imports or transfers from allies to endow them with initial capacities.

Three major conclusions arise from this study. First, North Korea (the Democratic People's Republic of Korea, DPRK) will continue to be a renegade supplier of missiles in the immediate and medium term. Second, South Korea (the Republic of Korea, ROK) is moving inexorably to obtain a missile/booster rocket capability in the medium term. Therefore, the ROK must join the Missile Technology Control Regime (MTCR). A reunited Korea

would end the DPRK's missile activities, but the fusion of DPRK with ROK capabilities would enhance the need to expand the MTCR to include the ROK. Finally, the MTCR is inadequate to the task of curtailing DPRK and/or ROK missile development activities and should be supplemented by other global or regional incentives to forego missile-related exports.

Definitions

In this study, "ballistic missile" is taken to mean a military weapon that uses a projectile to deliver a warhead to range of 50 or more kilometers. To be "ballistic," the missile must arrive by following "gravity's rainbow" rather than under its own power. Multiple rocket launchers are included; long range artillery pieces are not. One exception to the general rule used in this study is that cruise missiles (which are not ballistic) are included.

A second important conceptual issue is "capability." Here, capability is defined to encompass the organizational, learning, and research and development techniques to design, manufacture, and deploy missiles, as well as such physical hardware that might be traded, imported, or exported. Thus, an important export (an example of which is given later in the DPRK-Egyptian transaction) is the ability to design and construct a missile manufacturing facility, as well as the missiles themselves. Relatedly, the capacity to train a foreign entity how to organize and indoctrinate its military to use a missile in military operations is also of great importance.

North Korean (DPRK) Missile Capabilities

Despite its technological backwardness, the DPRK has managed to produce a variety of missiles. It is capable of supplying materials for missile bodies, warheads, and propellants. It can manufacture and assemble effective short and intermediate range missile systems. Known missile production entities include the Changgwang Credit Corporation, the Lyongaksan Machineries and Equipment Export Corporation, the No Dong 1, SCUD Development Project, and the Ordnance Factory in Chongin.[3]

The DPRK's electronics capabilities are still primitive, in spite of acquisition of a UN Development Program-supported integrated circuit factory known as the Pyongyang Semiconductor Manufacturing Factory. (The plant involved was an obsolete facility obtained from India, the only supplier willing to circumvent CoCom controls.[4] It has no ability to develop infrared seeker systems, although it must be producing an infrared system used on SA-7s made in the DPRK, whether by imitation or import-and-assembly. Its high precision technological capabilities remain elementary.[5]

The DPRK's missile program is also hampered by lack of funds and by its poorly skilled work force. That the DPRK continues to commit so many

valuable and scarce resources to such a large scope and scale missile program—especially when considered in combination with its nuclear research and development program—indicates its high priority to the North Korean leadership. But neither Kim Il Sung's "on-the-spot" guidance nor his voluntarist ideology can overcome these absolute limitations. These constraints dictate that the DPRK can climb only to the obsolete rungs at the low end of the missile research and development ladder.

DPRK Surface-Surface Missiles

The DPRK missile program began with shorter range ballistic weapons such as artillery shells and multiple rocket launchers, progressing on to longer range and more potent SSMs and SAMs. The main precursor of the North Korean SCUD B program involved the first SSMs obtained after the 1967 DPRK-Soviet agreement to resume military aid.[6] The first FROG (free-rocket-over-ground) missiles were transferred about 1969-70 when the Soviets transferred FROG 3, FROG-5 and FROG-7A missiles.

In the mid-1970s, the DPRK initiated a program to indigenously produce a local version of the FROG-7A. It remains unknown publicly whether North Korea ever actually produced any FROG missiles. The Soviets had supplied only high explosive warheads with the original FROG missiles. One American source contends that the North produced a chemical warhead for the FROG systems.[7]

One military analyst suggests that the DPRK effort to reverse-engineer the FROG-5 was a direct response to US forces deploying *Lance* missiles in the South or (more likely) the US transfer of *Nike Hercules* SAMs and *Honest John* SSMs to the ROK after 1976.[8] However, the *Lance* was first deployed (for a short period during exercises) to the ROK in 1971, well before the DPRK initiated its FROG program. The *Lance* was not stationed in the ROK until February 1987 and was withdrawn in late 1991/early 1992. The United States transferred *Nike Hercules* after 1976, after the DPRK began to develop its own FROGs. The *Hawk* was not transferred until 1979.[9]

SCUD B. As of February 1991, the DPRK allegedly had produced about 50 SCUD B missiles per year since 1987.[10] A 1989 US study, however, estimated that the DPRK produces 88-110 SCUD B missiles per year.[11]

A South Korean source states that the DPRK imported Soviet-made SCUD missiles from Egypt in 1983.[12] A US source puts the transfer much earlier, in 1976, when the North ended its program to upgrade the FROG-7A.[13] Sales to Iran also played an important role in financing the DPRK program (see below).

In 1984–87, the DPRK test fired a variant of a North Korean produced SCUD B missile.[14] As of mid-1992, all tests were over the Sea of Japan.[15] Since 1987, a missile plant near Pyongyang has produced the operational version of the missile.[16] One report times the deployment of operational

SCUD B missiles in the DPRK military as late 1988.[17] North Korea likely deploys the missiles in brigade-sized units of 12-18 launchers.[18] It has been suggested that the DPRK used 156 heavy duty logging trucks imported from Nissan as transporters for mobile SCUDs.[19]

As the SCUD missile is not very accurate, the DPRK deployment has generated speculation as to its possible arming with nuclear or chemical warheads. American officials believe that it would take the DPRK many years to develop a miniaturized nuclear device that would fit on top of a SCUD rather than onto a truck, railroad boxcar, or military transport plane.[20] In July 1991, the ROK Ministry of Defense claimed that the North had already produced more than a 1,000 tons of chemical warheads for its SCUD brigades.[21] This estimate may be hyperbolic as the North is said to field only 54 surface-surface missile launchers[22] and at its estimated annual output of fifty SCUDs, has produced only about 250 SCUD Bs (including exports) since 1987.

In 1990, South Korean newspapers reported US media stories that two units of SCUD B missile launch pads were being built in the Demilitarized Zone itself. These sites were reportedly surrounded by SA-5 SAM launchers and radars. In February 1991, a South Korean government official stated that the DPRK had at least 12 launchers stationed 40–50 km north of the Demilitarized Zone.[23]

Modified SCUD. South Korean sources state that the DPRK began developing a modified version of the SCUD in 1988. (This missile is sometimes referred to as the SCUD-PIP or "product improved.") The major DPRK motivations for developing the extended range SCUD B included: (1) a drive to earn foreign exchange (or to barter missiles for oil or rescheduled debt to oil suppliers such as Iran); (2) the inability of the DPRK-produced SCUD B to hit rear areas of the ROK and US bases in Japan as well as Japan itself; (3) a wish to offset ROK ballistic missiles acquired from the United States; (4) a desire to compensate for its abandonment in the late eighties by its major security patron, the former Soviet Union; (5) the acquisition of political prestige among developing countries; and (6) a desire to achieve regional power status by virtue of its missile reach.

Although the DPRK military receives a notional budgetary allocation, it is largely self funding. To this end, it controls a major portion of the North Korean industrial base, including exports such as SCUD missiles. Thus, the missile export push from North Korea may relate as much to the DPRK military's desire to alleviate its own budgetary squeeze as to reducing the current account deficit of the whole DPRK.

Joseph Bermudez suggests that Egypt and the DPRK agreed in the mid-seventies to cooperate in upgrading the SCUD B after the Egyptian-Soviet security alliance ruptured in 1976. However, technological deficiencies

forced the partners to rely on the PRC to supply the requisite design expertise and a better gyroscope for the improved guidance system.[24] The PRC connection was reportedly canceled in 1978.

In the early eighties, Egypt and the DPRK are said to have exchanged information and technicians to permit the missile to be reverse-engineered and upgraded, leading to the transfer of a small number of Egyptian SCUD Bs to the DPRK in about 1981.[25] An unconfirmed report in 1988 stated that the DPRK helped Egypt's defense industry to build its own SCUD B production plant and sent a number of technicians to Egypt to work on the project.[26] According to intelligence sources cited by Bermudez, the PRC also supplied rocket engine design, production, metallurgical, and airframe technology to the DPRK-Egyptian project.[27]

A 1989 Associated Press journalist suggested that the DPRK stepped into the breach after Egypt pulled out of a joint project with Argentina and Iraq to produce the *Condor II/Badr 2000* intermediate-range missile. The article cited an Israeli military analyst as saying that the DPRK might be renewing old Soviet SCUDs for Egypt, or upgrading them with improved components such as guidance systems.[28]

The North may also have attempted to obtain necessary technology for the program on the gray or black markets. In 1984, for example, two people were charged in New York with attempting to smuggle to the DPRK electronic components used in missile-guidance and night-vision systems.[29] A Japanese source claims that the DPRK also tried, in 1986–88, to acquire electronic equipment and information on cruise missile guidance systems from Japanese-Korean scientists, organizations, trading companies, and from Japanese researchers invited to visit the North. The report also cited an unconfirmed story attributed to a US official source that the DPRK had obtained the blueprint for part of the *Nike* SAM guidance system for ¥300 million.[30] Some analysts explain Japan's October 1988 expansion of its ban on missile system exports to cover missile-related components (including production machinery, rockets, guidance systems and propellants) as a response to these DPRK efforts.[31]

The modified missile was expected to be ready for manufacture and deployment sometime in 1992.[32] The new missile is reportedly 15.1 meters long and 1.3 meters wide with a range of greater than 600 km. Bermudez states that the SCUD-PIP entailed enlarging the fuel and oxidizer tanks, modifying the rocket motor, and adding a new guidance system.[33] [*Bermudez refers to this missile as the "SCUD Mod B" in his chapters on Egypt and Iran—ed.*]

The South Korean press reported in 1991 that US intelligence sources confirmed that the modified SCUDs were loaded at a military test site north of Pyongyang in May 1990 and that the DPRK was preparing a test firing from a coastal region of North Hamkyong Province.[34]

In November 1990, the US media reported US intelligence leaks that the North was preparing a second test from near No Dong of the modified SCUD after the first test ended in apparent failure in an explosion at a launch site near To Kol on the east coast. These articles also identified two radar sites about 30 km from the launch site for missile test tracking. The US sources estimated the range of the missile to be 520–780 km depending on the size of the warhead.[35] In October 1991, the DPRK finally successfully test-fired the missile into the Sea of Japan.[36]

DPRK Cruise Missiles

The DPRK probably also fields 12-15 SS-C-2b SAMLET anti-ship cruise missiles (that arrived from the Soviet Union some time after 1967) as well as Chinese HY-2 SILKWORM missile batteries.[37]

The US Defense Intelligence Agency states that the SAMLET coastal defense missile has been observed in North Korea since September 1965. The missile is 8.3 meters long and weighs 2.75 tons with a range of 90 km. It cruises at an altitude of 1 km at 0.8 mach. It is guided by autopilot with mid-course beam radar and radar terminal homing. The DPRK became capable of manufacturing the SAMLET sometime between 1975 and 1985.[38]

The DPRK Navy's missile attack boats were equipped by the Soviets with SS-N-2A/STYX anti ship missiles after 1967, even though there is no known local manufacture nor export of these missiles by the DPRK.[39] The STYX missile is 6.6 meters long and cruises at 90–300 meters at 0.9 mach. It has a maximum range of 45 km and carries radar or infrared homing seekers.[40] The missile has a 0.5 ton high-explosive warhead.[41]

There is no evidence that the DPRK has replicated the Chinese version of the STYX, the SILKWORM.[42] Two US analysts have suggested, however, that the DPRK initially produced SILKWORM components in the mid-seventies, and later produced entire systems including motors and guidance systems (incorporating Chinese supplied parts) in the early eighties. The DPRK has served as a conduit for Chinese arms shipments to Iran and possibly Iraq. In 1986, Iran obtained SILKWORMs which it fired at ships anchored in Kuwaiti waters the following year. Under intense international pressure, the PRC agreed to halt the supply, but the Iranians continued to field the weapon.

North Korea's willingness to supply Iran enabled China to deny in 1987–88 that it was exporting SILKWORMs, by claiming that third parties beyond its control were providing the missiles.[43] The SILKWORMs were shipped reportedly either by cargo vessel or via Iranian B-747 cargo planes flying from Pyongyang via the PRC directly to Iran, overflying Afghanistan or the former Soviet Union.[44] In December 1986, the Iranian Government obligingly rescheduled the entire DPRK debt for oil.

DPRK Surface-to-Air Missiles

The DPRK deploys a dense network of 54 surface-to-air missile sites. Excluding the SA-7, it has about 800 air-defense missiles, including the SA-2, SA-3, SA-5. There are also more than 5,000 hand-held SA-7 surface-to-air missiles.[45]

SA-2 GUIDELINE SAM. North Korea may have acquired the SA-2 because it was frustrated by the increasing numbers of US U-2 high altitude overflights of the North flown from Japan and Taiwan.[46] North Korea is believed to have two types of this missile, the SA-2b and SA-2f.[47] The SA-2/GUIDELINE missile provides medium range, medium altitude point defense for cities and airfields and a barrier defense along the Demilitarized Zone.[48] It has a maximum altitude of 27.4 km and a maximum range of 35–50 km.

One source states that the Soviet Union provided the SA-2 to the DPRK as early as 1960 and that the first operational KPA battalion entered service in 1962–63. Five battalions were operational by 1965, equipped with some 250 SA-2 missiles. The Soviet supply dried up during the early sixties due to the Sino-Soviet dispute, but resumed after 1967 and continued until the mid-seventies.[49] One US report states that the SA-2 system was upgraded by the Soviets in 1985.[50] It is also possible that the DPRK obtained the Chinese upgrade of the SA-2 in the mid-seventies. US analysts believe that such a missile was fired at a US SR-71 spy plane in August 1981.[51] In the mid-eighties, the DPRK reportedly transferred this technology to Egypt to facilitate Egypt's variant of the SA-2, the *Morning Bird* missile.[52]

Joseph Bermudez suggests that the DPRK obtained technology from the PRC that enabled it to indigenously maintain, modify and upgrade its SA-2s. After the Soviets refused to deliver upgrades of the system, the DPRK asked China to supply its own reversed-engineered version of the SA-2. The Soviet refusal may have been the pivotal event that motivated the DPRK to establish an indigenous missile capability.

SA-3 GOA SAM. In the mid-eighties, DPRK-Soviet security relations improved. In 1985, the Soviet Union supplied the DPRK with the SA-3 (and associated launchers) which provides short-range defense against low-flying aircraft or helicopters for major cities.[53] It has a maximum altitude of 12–18 km and a range of 18–22 km.

SA-5/GAMMON SAM. North Korea is said to have imported about thirty SA-5s and the related TIN SHIELD early warning/ground intercept radar from the former Soviet Union after 1987.[54] Fired from a launch pad, the SA-5 can intercept aircraft at altitudes of 0.3 to 30 km and has a horizontal range of 250–300 km.[55]

In 1987, the DPRK deployed the SA-5 missiles in the southern sector along with early warning radars.[56] A US account stated that a new batch of

SA-5s was installed in April-May 1988 at four sites about 60 km north of the Demilitarized Zone. An official noted that they could hit air traffic into Kimpo International Airport and were part of the war of nerves against the ROK during the Olympic Games.[57]

SA-7 GRAIL SAM. The shoulder-fired SA-7 is portable and is used to attack low-altitude, low-speed aircraft. A South Korean source states that the SA-7 was introduced from the Soviet Union in 1974.[58] It has a maximum altitude of 5.5 km, a maximum slant range of 6 km and a maximum speed of mach 1.5. It uses infrared guidance. South Korean authorities claim that the North has deployed 12 of these mobile units 40–50 km north of the Korean Demilitarized Zone while the Pentagon stated in 1990 that 54 SA-7 units exist. The SA-5 and SA-7 SAMs are deployed in 50 bases spread over North Korea and around key sites such as airports and military facilities. South Korean sources state that the DPRK has produced about 100 SA-7 SAMs per year since 1979 at an ordnance factory in Chongin.[59]

South Korean (ROK) Missile Capabilities

South Korea's capabilities to manufacture and export missiles derive primarily from its modification of missiles transferred by its security patron, the United States. Consequently, the ROK has not imported theater or intermediate range missiles to date nor developed self-reliant missile design and production capabilities (see Table 6.1).

Since the mid-seventies, however, the ROK has developed indigenous missile production capability to manufacture rockets and parts or systems for exports. In the longer run (after 2000), the ROK will likely become an active participant in the world aerospace and space industries. At that time, the ROK would be space booster rocket- and therefore ICBM-capable. To date, however, the ROK Government has not committed itself to that goal. Nor has the ROK exported any missiles. It has little to offer the international missile market in the short run.

ROK Acquisition and Modification of US Missiles

Since 1953, the United States has deployed a long list of ballistic and cruise missiles in the ROK. Until the mid-seventies, it retained sole control over weapons, crucial communications and intelligence assets, and major missile delivery systems. To compensate for his withdrawal of US troops, President Jimmy Carter authorized US *Nike Hercules* and *Hawk* missiles left by departing US forces to be transferred to ROK forces.

Nike Hercules *Missile.* The indigenous ROK missile research and development capability began with a US Military Aid and Advisory Group-supervised maintenance facility for US *Hawk* and *Nike Hercules* missiles which commenced in 1972.[60] The ROK Army's missile maintenance

TABLE 6.1 South Korean Firms with Missile-Relevant Capabilities

Name	*Activity*
Doo Won Heavy Industrial Co.	Missile Body
Sam Sun Industrial Co.	Kooryong Multiple Rocket Tube
Daewoo Heavy Industries	Aircraft Fuselage and Parts
Tong Myung Heavy Industries Co.	Hydraulic system for *Nike Hercules* missile and launcher; multiple rocket launcher
Chun Ji Industrial Co.	Missile Components
Hankuk Fiberglass Co.	Major Missile Products
Samsung Aerospace Industries	Rockets and Propulsion Systems

Source: Korean Defense Industry Association, *Korean Defense Business Directory,* Seoul, no date, circa 1991.

depot was known as PROJECT SILVER RIVER.[61] These efforts were organized as the ROK Army Nike-Hercules Cooperative Engineering Program and the ROK Army's Nike Hercules Improvement Program.

ROK personnel were trained in 1975 by the US military and Raytheon Corporation to operate and improve a ROK commercial missile maintenance operation established in late 1974. The techniques transferred to the South Koreans included electronics, conventional warheads, and conversion to surface-surface operation.[62] Training of ROK Army personnel in the *Nike* system began in January 1975. A core group of fifty-five ROK Army personnel was sent to Fort Bliss, Texas, and Redstone Arsenal, Alabama, where they learned the mechanics of the system. Another 106 South Korean maintenance personnel were trained at the *Nike Hercules* Training Center at Taegu in South Korea. South Korean troops augmenting US forces in Korea provided 703 less highly trained personnel who were infused into the six US firing batteries. In May 1977, US Forces Korea was transferring *Nike Hercules* battalions to the ROK[63].

On July 1, 1977, the 2nd Battalion of the US 44th Air Defense Artillery—then the largest *Nike Hercules* battalion in the world—was turned over to the ROK Army which redesignated it the 38th ADA (Air Defense Artillery) of the ROKAADCOM (Republic of Korea Army Air Defense Command). Even then, these weapons remained under US operational control due to the combined command arrangement implemented in 1978.[64]

In 1977, the ROKAADCOM had two air defense artillery brigades. The 1st Brigade was assigned two Basic *Hawk* battalions, a *Nike Hercules* battalion, and a weapons battery. The 2nd Brigade had a Basic *Hawk* battalion, a weapons battery, and a newly transferred *Nike Hercules* battalion.[65] In 1978,

the ROK military procured from US forces in Korea two additional *Nike Hercules* batteries.[66]

Upon receipt of the *Nike Hercules*, the South Korean military promptly test fired it in its surface-surface mode on September 26, 1978 in South Chungchong Province. Many accounts of this event have incorrectly characterized this activity as modifying the US missile. However, the *Nike Hercules* had been assigned a ground-to-ground mission ever since 1960. All that was required of the ROK military was to reset the target range, azimuth, and elevation in the target tracking radar, and dial the correct settings on the computer. In ground-to-ground mode, the missile is fired, tracked by the missile tracking radar, and steered toward an aiming point above the target. At the right moment, the missile is commanded to dive so as to hit the target on a ballistic trajectory. The US Army claims "pin point" accuracy for this role.[67]

The whole operation was carried out by the ROK Agency for Defense Development.[68] The upgrade reportedly included solid state electronics for greater reliability, and improved conventional warhead munitions.[69] The range is said to have increased from the original 150-odd km to about 250 km.[70] One unconfirmed account mentions reports hinting of South Korean-Taiwanese collaboration on this project.[71] Gerald Steinberg notes that while it is technically difficult, the range of a modified *Nike Hercules* system could be extended significantly by vertically stacking three identical stages (and smaller stages can be clustered horizontally). Stacking limits the performance of individual stages; requires more non-burnable structure; may increase drag due to larger cross sections associated with clustering; and demands better attitude control, all of which make it unlikely that hybrid systems will appear early in a modification program.[72]

As *Ground Defence International* commented in 1979, "It may not be too difficult [for the ROK] to obtain a nuclear charge and thus produce a fine tactical nuclear weapon." As they noted laconically, doing so would also be "quite dangerous."[73] Certainly, the Korean *Nike Hercules* could deliver a 0.1–5 ton warhead a considerable distance.

In 1991, the ROK had 200 *Nike Hercules* missiles organized into two battalions at 10 sites.[74]

Kooryong *Multiple Rocket Launcher.* In the same year, the ROK Army advertised its development and successful testing of a domestically produced multiple rocket launcher, the 130 mm, 30-round *Kooryong* MRL manufactured by Daewoo Heavy Industries. The rocket propulsion system for the *Kooryong* MRL was developed by Samsung Aerospace Industries in December 1977 for the ROK Army.[75] This weapon can fire a high explosive, variable time warhead to a range of 32 km. The weapon was deployed in 1990 in 18-launcher MRL battalions at corps level.[76] As of mid-1992, Korean

and American officials state that the ROK has not exported any *Kooryong* MRLs because its price is uncompetitive.

Hawk *Missile.* The US Army introduced the *Hawk* missile into South Korea in August 1960. The MIM-23B *Improved Hawk* has been deployed with the US Army since 1972. The *Hawk* is an all-weather low to medium altitude air defense SAM with a range of about 40 km. It uses a proximity-fuzed warhead with 73kg of high explosive.[77]

In 1977, 40 ROK Army officers already experienced in Basic *Hawk* operations were sent to Fort Bliss, Texas, where they were trained in Improved *Hawk* maintenance.[78] In May 1977, many of the *Hawk* battalions had already been turned over to the ROK as part of the force compensation package associated with Carter's withdrawal policy.[79]

By January 1978, the US cost-free transfer to the ROK of missiles had been limited to one battalion of *Improved Hawk* equipment.[80] The final congressional budgetary authorization for cost-free transfer of missiles and other equipment to the ROK did not pass until late 1978. In May 1978, the US Defense Secretary stated to the Senate Foreign Relations Committee that US personnel in Korea would be assigned to assist ROK personnel learn to operate the *Improved Hawk* system. Guidance was actually issued on October 27, 1978 that stated that technical and operation-type training would be conducted as on-the-job training. About 20 US Eighth Army personnel were assigned, in June and July 1978, to the ROK Air Defense Artillery School at Taegu to conduct *Hawk* training for ROK troops.[81]

On July 20, 1982, the 2nd Battalion of the US 71st Air Defense Artillery transferred its mission and *Hawk* missiles to Battalion 188 of the ROKAADCOM.[82] In February 1982, the Reagan Administration proposed the sale of 170 *I-Hawk* missiles and 723 rocket motors to the ROK for $68 million. In 1985, the U.S. offered to sell the ROK modification kits for 28 battery sets of the *Hawk* product-improved version plus spares and services for $61 million. In March of 1987, another offer was made for the same equipment for an estimated $84 million.[83]

In 1991, the ROK had 110 *Hawk* missiles organized into three battalions at 24 sites.[84]

Honest John *Missile.* When the *Honest Johns* were first transferred to the ROK military remains uncertain. In 1972, the ROK already had one *Honest John* missile battalion.[85] In 1976, the US Army had decided to deactivate its *Honest Johns* in the ROK, even before President Jimmy Carter's election.[86] Certainly, the *Honest Johns* had been transferred by the time the Pentagon audited the activity in September 1978.[87]

The transfer of the *Honest John* system to the ROK was conducted by a single US representative who documented that every article transferred was in exactly the same condition (used, usable without repairs, and good).

The audit report refers to the transfer of an *Honest John* battalion, *Honest John* rocket warheads, and *Honest John* rocket motors to the ROK.[88] One military journal states that the ROK Army has modernized the *Honest John* with a new guidance system and transformed it into a SSM.[89] It has also been reported that the modified *Honest John* was tested by the ROK military in 1978.[90]

In 1979, the last active US *Honest John* battalion retired from South Korea. Its equipment and missiles were turned over to ROK Army forces.[91] Given the alleged short warning times of North Korean attack, the *Honest John* missile is of dubious military utility because its propellant must be warmed with a special electric blanket for 24-48 hours prior to firing.

In 1991, the ROK had 12 *Honest John* missiles organized into two battalions.[92]

Lance. In 1973, shortly after the nuclear-capable *Lance* missile entered the US Army's arsenal, the missile was included in US Forces Korea's operational planning and was briefly deployed to Korea during annual exercises. The US Army stationed its first battery of *Lance* missiles in the ROK on February 9, 1987. The battery became operational in early March.[93] Although the ROK Army requested the *Lance* from the United States during the Carter withdrawal program, this request was refused.[94] The last US *Lance* unit withdrew from the ROK in early 1992, probably as part of the US withdrawal of tactical nuclear weapons from Korea at that time. As far as is known, ROK forces played no direct role in *Lance* deployments in Korea.

Harpoon *and* HARM *Missiles.* In 1978, the ROK purchased *Harpoon* anti-ship missiles and air-to-air missiles.[95] The ROK program to develop a locally made fighter-bomber aimed to obtain US *Harpoon* anti-ship missiles and the HARM (high-speed anti-radiation missiles).[96] The ROK Navy is now armed with *Harpoon*, *Standard*, and *Exocet* missiles imported from foreign suppliers.

Atlas Centaur *IRBM.* Although Carter reversed his withdrawal policy in 1978, the ROK military continued to seek additional ballistic missile capability. In 1979, for example, it tried to acquire the US *Atlas Centaur* IRBM. First deployed by the United States in 1959, the *Atlas Centaur* could lob a W-38 nuclear warhead over 7,000 km with one-mile accuracy.

It remains unclear whether the missile software, designs, and hardware that the ROK had bought were actually transferred or blocked by the State Department under pressure from the US Congress. The sale reportedly included nose cone materials, alloys, guidance systems, specifications, engineering drawings, instructions, and assembly equipment.[97]

Patriot *Missile.* After the 1991 Gulf War, the ROK expressed interest in acquiring the *Patriot* SAM, and the *Patriot* was deployed briefly to the South during US-ROK exercises in 1992.[98] However, the fact that the *Patriot* is a point-defense weapon of little use in defending large areas and has almost

no time to react to a DPRK SCUD attack led the ROK government to not seek the *Patriot* after all.[99] Relatedly, the ROK government registered as an ally interested in participating in joint research with the US Strategic Defense Initiative Organization but no concrete capability is believed to have come of this connection.

Indigenous ROK Missile Research and Development Capabilities

Under President Park Chung Hee, the ROK began to gather the requisite resources to design and develop its own missiles. Indeed, a CINCPAC study team noted in May 1971 that the Research Agency for Defense Science (established in August 1970 to increase defense industrial self-sufficiency) was allocating scarce personnel and laboratory resources to "relatively sophisticated areas such as guided (missile) weapons and laser application"—even before basic production engineering functions had been addressed.[100] The Agency's staff included Ku Sang Hae, a doctoral graduate of the University of Saskatchewan and specialist in the field of rocket engineering.

In December 1975, the ROK Government purchased the Lockheed Aircraft Corporation's complete facilities for manufacturing solid-fueled rocket motors. Most of the production equipment of the now-defunct Lockheed Propulsion Company (then near Redlands, California) was shipped to South Korea in 1978. The ROK paid two million dollars for the equipment which produces motors for only two purposes; either for propelling military missiles and rockets; or for space launch rockets. Lockheed had tried unsuccessfully for more than a year and a half to obtain US Government approval for the sale and to set up a training program to teach ROK personnel how to manufacture solid rocket propellant, the same kind used in *Minuteman* and *Polaris* missiles. Lockheed later dropped the plan to provide training and technology transfer to the ROK and sold its plant to the Berkeley-based Pacific International Corporation which managed to obtain a US Commerce Department license to export the equipment.[101]

The ROK continued its own ballistic missile research and development program until about 1980 when it was discontinued for lack of finance and due to US pressure.[102] In the late eighties, influential South Korean defense intellectuals advocated that the ROK should develop military capabilities requisite to a strategy of offensive deterrence against the DPRK. Kim Chol-hwan of the National Defense College, for example, argued in 1989 that the ROK should develop CSWS-class SSMs with multipurpose cluster warheads and a 200 km range, as well as intermediate range (400 km) anti-ship guided missiles. He also called on the ROK to acquire 2,000 km range SSMs with land, air and submarine launchers to counter what he called the ROK's secondary threat, Japan and China.[103]

ROK SAMs and SSMs. The ROK missile program revived in 1990 when the Agency for Defense Development initiated a program to indigenously manufacture a SAM to replace the existing *Nike Hercules* SAMs, and an SSM to replace the US-supplied *Honest John* and US-controlled *Lance* missiles in South Korea. The SAM project entails fabricating a version of the French defense firm Thomson-CSF's *Crotale* SAM. The *Crotale* is a SAM designed for anti-aircraft defense for armored formations and surface vessels. The South African government funded the development of the missile and—apart from the French military—is the major user of the terrestrial version (with other export sales up to 1989 to Abu Dhabi, Chile, China, Egypt, Greece, Kuwait, Libya, Pakistan and Saudi Arabia). The missile is 2.89 meters long, 0.15 meters wide, flies at mach 2.3, weighs 85 kg, and has a maximum range of 13 km. Thomson-CSF DSE was selected as prime contractor for the main weapon system.

The ROK version reportedly will use ducted motors to propel and maneuver the rocket. Goldstar Precision is developing a semi-active homing head and an infra-red proximity fuse. Live tests were planned for late 1991. Daewoo Heavy Industries Aerospace Product Division is also involved in developing the missile. Samsung Aerospace Industries signed a contract in November 1989 with Thomson-CSF to build the SAM system under license. Samsung has two facilities located at Changwon, and a third being built at Sachon.[104] Samsung was to deliver operational missiles in early 1992.[105]

The ROK is also developing a group of SSMs with ranges from 100-900 km. Samsung is heading a consortium of companies to produce the SSMs. The ROK may be developing penetration warheads for these missiles.[106]

Role of Agency for Defense Development. The ROK Agency for Defense Development is crucial to both these efforts, providing funds, managing research and development programs, and integrating systems developed under contract by different private firms (as with the *Kooryong* MRL mentioned earlier). This mix of public and private enterprise in the South contrasts with the North Korean model of military-owned and managed missile enterprises.

Aerospace Sector

In the eighties, the ROK military pushed for greater autonomy and self reliance from its US counterpart. Anticipating eventual US withdrawal, the ROK military is developing greater self reliance in command, control, communications, and intelligence systems; maritime patrol aircraft; airborne early warning aircraft; electronic warfare; ground-based air defense; and artillery target acquisition radars.[107]

The growth of its aerospace industry will endow the ROK with a variety of missile-relevant capabilities. South Korea aims to have a $10 billion annual aerospace industry by 2000. The program began in 1978 when then ROK President Park Chung Hee promulgated the Aerospace Industry Development Act.[108] It was followed in 1987 by the Aerospace Industry Development Acceleration Act. In December 1985, the Aerospace Industry Committee (later reformed into the Committee of Aerospace Industry Aid) was comprised of the Ministries of Defense, Trade and Industry, and Science and Technology.[109]

In 1989, the Ministry for International Trade and Industry published a sectoral development strategy that stated three goals. These were that the ROK would: (1) develop domestic capability through licensed production for domestic needs; (2) partake in international commercial aircraft co-development; and (3) become a world-favored maintenance depot and parts manufacturer.

In April 1990, President No Tae Woo created a new aerospace committee and drafted an Integrated Aerospace Industry Governing Law.[110] This law created new offset guidelines to increase the level of technology transfer and buy-back provisions under licensed production agreements. It also created a cooperative framework between government, private industry, universities, and research institutes backed by a special governmental committee.[111]

The aerospace program was part of a national effort to upgrade ROK high technology capabilities in new materials, microelectronics, bioengineering, chemicals, and optics as well as aircraft. In time, these dual-use technologies could enhance ROK military technology in missile-related guidance, communications, intelligence, and fire control systems.[112]

As of 1990, the ROK had 17 aerospace enterprises of which five have invested major resources in aircraft projects that include missile-relevant technologies. These firms are Samsung Aerospace Industries, Daewoo Heavy Industries Aerospace Production Division/Daewoo Sikorsky, Korean Air's Aerospace Division, Sammi Augusta, and Hyundai.[113] In addition, another eight firms, with ties to 100 odd lesser and local aerospace firms, are responsible for airframes, engines, avionics, airframe accessories, and parts production. In addition to these specific manufacturing capabilities, the aerospace sector has also established research and development capabilities that could be drawn on in a ROK missile/booster rocket program. These include: Daewoo's research and development center at Taejon (established in 1988); the government funded Korea Aerospace Institute (October 1989); and the Korea Aerospace Research Institute (1989).[114]

Although missiles are not part of this aerospace program, it endows the ROK with the technological basis to make its own booster rockets and ballistic missiles. The pace of this accretion, however, is greatly retarded by the 90 percent plus shortage of scientists and engineers needed to fulfil

existing plans and priorities of the aerospace sector, let alone missile or booster rocket ventures.[115] Thus, the ROK's major capabilities to enter the missile market will likely emerge from dual-capable technologies acquired directly for its endeavors in space—the subject of the next section.

ROK Space Systems

In January 1985, the ROK Ministry of Science and Technology announced a draft decade-long space development plan comprised of three phases: planning, technology development, and industrialization of the technology. A MOST official stated that the draft plan recommended that the ROK shoot domestically-produced satellites via Korean-made rockets into outer space by the early nineties.[116]

In 1987, the director of the ROK Astronomy and Space Science Institute declared that the Institute would concentrate on developing rocket-launching technology to fire a rocket for observation purposes into space by 1991. He also stated that South Korea aimed to launch a research satellite into orbit in 1996 using a Korean booster rocket. He added that the ROK should have developed a sophisticated space launcher rocket and commercial communications satellite by 2001. He revealed that a key element of the strategy is the repatriation of some 200 Korean space scientists active in the US space industry to tackle technological development essential to a ROK space program.[117]

By 1989, space and aeronautics technologies were two of four core technologies in the ROK high-technology strategy. (The other two were transit and ocean technology.) The basic space concept was said to be to secure the skilled personnel and essential technology to produce domestic satellites and to complete 80 percent of the development of a ROK satellite launcher by 2001.

In 1989, the ROK government announced that it would fund scientific research into system and structural rocket design; solid and liquid propellants; and ignition, guidance, and control technologies. The first phase of the ROK program called for a small rocket to be developed for aerial observation purposes over Korea by 1995; and a rocket to launch a Korean-built satellite by 2000. The satellite program called for the development of a 50–100 kg satellite by 1995, and a 100–200 kg satellite for scientific exploration and communications experiments by 2000.[118] In December 1989, the Ministry of Science and Technology announced at a meeting with ROK President No Tae Woo that it would actively pursue joint research with France and West Germany in a variety of high technologies, including space sciences.[119]

On February 16, 1990, the ROK Minister of Science and Technology, Yi Sang-hui, announced that an earth observation satellite built with Korean technology will be launched in 1993. The US$116 million project includes joint development by 1996 of a rocket with foreign suppliers. It would be

used to launch a 200–400 kg Korean satellite into 500 km orbital altitude by 1999. (The Koreans plan to use the US *Pegasus* launch system that fires the rocket from a plane flying at a 12 km altitude, thereby obviating the need for a launch site).[120]

The project is intended to enable South Korea to obtain observation equipment and computer technologies to analyze information gathered in space. The project is to be coordinated by the Korea Research Institute of Aerospace (KRIA, set up in October 1989) on behalf of the Korea Advanced Institute of Science and Technology, the Agency for Defense Development, universities, and industry. The KRIA declared that it intended to pursue joint research with agencies in the United States, Japan, and France to achieve its objectives.[121] The following November, the ROK military called for domestic development of its own military spy satellite to compile various data on North Korea.[122]

In spite of these developments, the ROK still lacks the basic technological infrastructure, legal framework, and commitment of governmental resources needed to enter space. A national space strategy has yet to emerge to overcome the various obstacles facing the ROK in this regard. One ROK official emphasized that the first generation of satellites will be an *ad hoc*, commercial endeavor, not a national space strategy.[123]

Korea Sat 1 *and* 2. South Korea's satellite plans crystallized in late 1991 when Korea Telecom called for bids to launch two identical domestic satellites in April and October 1995 into geosynchronous orbit. Both satellites will combine communications and direct broadcasting. The ROK wants its own satellite rather than leasing satellite services to obtain a high transmitting power so that the receiving antenna can be reduced to 30–40 cm in width at an affordable price. In comparison, a receiving dish for the *Asiasat* broadcasts is a meter in diameter.

Korea Telecom is taking the lead in funding and managing the satellite program, in large part because it is financially healthy and self-financing out of revenues. Korea Telecom already has a strong research and development capability to support the program. Nonetheless, as of late 1991, it had committed less than US$1 million—what one official termed a minuscule "piggyback" program on the basic space mission. Nonetheless, the ROK will launch its first scientific satellite, KITSAT-1, in July 1992; and plans a second in 1993.[124]

Korea Telecom, a public corporation, intends to maximize the transfer of satellite systems engineering and launch technology to Korean firms as part of the satellite supply contract.[125] It is therefore encouraging foreign bidders to team up with South Korean partners. The supplier will contract to transfer to south Korean firms systems engineering skills, including the associated capability to design, construct, maintain, and operate a satellite ground station that will be completed six to nine months before *Korea Sat 1*

is launched. There were four bidders for the first two satellites: GE with Goldstar/KAL; Hughes with Samsung; Space Systems (formerly Ford Aerospace) with Hyundai; and British Aerospace with Daewoo. GE Astro was awarded the contract to build the first satellite.

Korea Telecom anticipates that the ROK will launch a second generation satellite in the late nineties, although no official commitments have been made to a follow-on program. A basic space law is being drafted, however, to establish a legal basis for a second phase in the space program.

Other ministries have expressed an interest in such space affairs as earth sensing and scientific satellites. The Ministry of Science and Technology has started to work on remote sensing, but the activity is more of a watching brief than an active program. As of early 1992, no funds were committed to the program.

Korea Sat *Launch.* In November 1991, Korea Telecom issued a request for proposals for the 1995 satellite launches. Korean officials state that the main criterion for awarding the contract will be cost. In the long run (post 2000), however, Korean officials believe that the ROK will build its own space booster rocket in spite of the expected tight controls on technology transfer in the immediate future. Thus, the launch contract will include technology transfer conditions, although ROK officials have a realistic appreciation of the likely constraints that suppliers of launch services will impose on this demand. "No-one is willing to share the technology," stated one official, "except the Russians who need cash and are a new factor, and perhaps China."

Constructing an indigenous satellite booster rocket would render the ROK an ICBM-capable state. To achieve this goal, the ROK would have to circumvent the missile technology control regime led by the United States.

It also would have to deal with the DPRK's reaction. Major General Kim Yong Chol, Director, General Staff Committee of the DPRK Ministry of Defense, stated in October 1991 that the DPRK is acutely aware of and monitors closely the South Korean space and booster rocket program. The DPRK's response, however, "is not to compete in technology. "So it's wrong," he added, "to think that when South Korea makes something, then we have to make it. We do things in our own way."

The general was equally clear that the DPRK perceives the ROK's program as a military threat: "We also think that if they have such a program, or want to have it, that this is preparation for war. It is not clear if it can be used against North Korea or not. Developing such a capability is already a threat. Especially during a confrontation, it logically means another threat to us. Even without forward deployment, they could easily target Pyongyang," he said.[126]

In sum, South Korea wants to obtain, import and manufacture missiles for at least five reasons: (1) to deter North Korean missile and conventional

military attack on the ROK; (2) to attack North Korean cities and important military targets in wartime; (3) to flex its muscles at a regional level, especially toward Japan; (4) to counter putative political-diplomatic prestige accruing to the DPRK by virtue of its missile capabilities and trade; and (5) to advance its aerospace industry for long-run economic advantage. In the future, the private structure of the South Korean defense industry may also facilitate "marginal" missile exports in the gray market, in the search for private profit by spreading investment costs over larger production runs.

In early 1992, the ROK had not committed itself formally to observing the norms and practices established by the MTCR. It has not acted in ways contrary to the regime either. ROK and US officials are optimistic that the ROK will maintain its conservative stance in this regard.

Korean Missile Transactions

The rest of this essay focuses on missile exports. It is divided into two parts. The first describes the missile exports of the North and its motivations for becoming a major missile supplier. The second reviews the various sets of disincentives to missile exports that confront both the ROK and the DPRK, although with very different outcomes in each case. The greater attention given to the DPRK's missile trade is inevitable because the ROK has not exported missiles.

Unfortunately, information on the security perspectives and policy-making process of the DPRK security elite is less available and reliable than for the ROK. This section on the DPRK's motivations is therefore based on secondary and even tertiary accounts and sources sometimes marred by disinformation and partisan bias. The reader is cautioned that major portions of the following account of the DPRK's missile exports cannot be confirmed.

DPRK Missile Import Motivations

The DPRK imported missiles: (1) to obtain military deterrence; (2) to prepare for warfighting; (3) to realize regional great power aspirations; and (4) to obtain profits and prestige accrued by re-exporting missiles.

Military Deterrence. The DPRK ballistic missile program deters three kinds of military threats. First, the northern security elite wants to deter a US-ROK combined missile attack. Second, the DPRK leadership develops missiles to enable it to deter a US-ROK nuclear or chemical attack by threatening to fire a chemical or (in the future) nuclear warhead. Third, Pyongyang may seek to offset the deterioration of its conventional military power relative to that of the ROK and US-ROK combined forces on the peninsula by deploying weapons of mass destruction.

Warfighting. In wartime, the DPRK could use its missiles in a variety of missions. First, the DPRK could emulate the Iraqi strategy of firing missiles to wage psychological warfare against urban populations, thereby creating massive refugee flows and complicating US-ROK military movements and logistic support. Second, missiles are useful (if accurate enough) to attack high value, large, and vulnerable targets (such as cities, large military bases, airfields, troop concentrations, or industrial facilities including nuclear power plants). The poor accuracy of its theater missiles, however, means that the DPRK cannot credibly threaten most ROK and US military targets such as hardened artillery emplacements, command posts, ammunition or nuclear weapon storage sites, etc.

Regional Power Projection. Undoubtedly, an ability to fire missiles at US bases in Japan (and possibly Russia in the future) is an important goal of the North Korean leadership. The DPRK's extended-range SCUD-B missile reportedly can already reach western Japan. In November 1991, Japanese Vice Defense Minister Akira Hiyoshi described the DPRK missile (combined with the DPRK's potential nuclear capability) as Japan's top security threat—a statement that would confirm and enhance the importance of this capability in the minds of most North Koreans who harbor bitter memories of Japanese colonialism and active support for the UN Command during the Korean War.[127]

DPRK Missile Export Motivations

Like its imports, the DPRK's missile exports are also driven by multiple motivations. These include: (1) offsetting the cost of missile and other military imports; (2) earning scarce foreign exchange with which to import other items essential to regime survival (especially oil and food); (3) developing a network of political-military relationships with which to counteract ROK diplomatic and mercantile triumphs, especially in the Middle East; and (4) responding to internal political-bureaucratic factors, especially the need of the DPRK military to finance itself.

DPRK Missile Export Policy

North Korea rejects criticism of its missile exports as "preposterous fictions" fabricated by the United States, calling the latter the "caudillo of the merchants of weapons of mass destruction."[128] It even denies outright that it exports any missiles. "Essentially," an official statement asserts, "our country, proceeding from its peace-loving foreign policy, values friendship and unity with other countries and *has not sold any types of weapons*."[129]

In reality, the DPRK has extensive capabilities to transfer missile production and organizational techniques as well as missile hardware (production technology or actual missile parts or systems). It has already engaged in both types of exports.

The organizations most likely to export missiles are the Weapons Bureau of the Korean People's Army which researches and develops weapons and administers weapons supply for each service; and the Military Munitions Production Bureau, which controls the production plans and production of munitions for each service.[130]

The rest of this section reviews the DPRK's export activities relating to China, Iraq, Syria, Iran and Libya. Most of this activity occurred during the eighties and represented a major national effort by the DPRK.

DPRK-China Connection. In March 1977, Secretary of the Korean Worker's Party Kang Song-san visited the PRC's Lop Nur nuclear test site and reportedly attended a reception hosted by the 7th Machine Industry Ministry, the agency that developed China's ballistic missiles (This ministry was renamed Ministry of Space Industry in 1982; and combined into the Ministry of Aerospace in 1988.). The substance of the DPRK-PRC missile technology connection remains wholly speculative, however.[131] As noted earlier, the DPRK has imported Chinese missiles to sustain its own missile deployments and development programs, and also acted as an intermediary for Chinese missile exports to the Middle East. Beyond that, little is known.

DPRK-Iraq Connection. In February 1991, the US State Department expressed concern at reports that the DPRK had sold more than 100 SCUD missiles to Iraq in 1988.[132] Pyongyang immediately denounced the US statement as a "cock and bull story" and claimed that the United States had fabricated "a fiction about 'supply of missiles'" to denigrate the DPRK's opposition to the Gulf War.[133]

A few months before the Gulf War, an Iraqi military delegation reportedly visited Pyongyang in quest of North Korean missiles and launchers. Nothing seems to have transpired from this unconfirmed event.[134]

As of late September 1992, almost none of the 60,000 pages of documents seized from Iraq by UN inspectors had been translated, although many of them reportedly describe the missile supplier network.[135] When this task is complete, more information may emerge as to the DPRK-Iraqi missile connection.

DPRK-Syria Connection. The Syrians reportedly sought SCUD missiles from the DPRK when the Soviet Union failed to provide long range missiles with which to strike Israel after the 1982 Lebanon war.[136] By about 1985, Syria is said to have developed chemical warheads for its stock of SCUDs. Joseph Bermudez has speculated that the DPRK was a direct or indirect supplier of this technology after the United States blocked Chinese supply to Syria and Libya (bankrolled by Libya's Qadafi) of 140 M-9 missiles. Syria may have negotiated also with the DPRK to purchase a variant of the SCUD B missile in late 1989 or early 1990. About 24 missiles and 20 launchers were reported to have been delivered to the Syrian port of

Latakia in early March 1991 after the North Korean vessel *al-Yarmouk* sailed around the Cape of Good Hope to avoid transiting the Gulf where it would have had to reveal its cargo.[137]

DPRK-Iran SCUD Transfer. During the Iran-Iraq war, the DPRK was a major arms supplier to Iran.[138] In June of 1987, Iran bought $0.5 billion of arms from the DPRK, including 90-100 DPRK-produced SCUD-B missiles. Iran used these missiles in the "war of the cities" in February-April 1988, firing approximately 77 SCUD-B missiles at Iraqi cities. The DPRK may have also assisted Iran to establish a SCUD-B manufacturing facility of its own.[139] It has been conjectured that the DPRK may have transferred chemical warheads or technology to Iran in 1988.[140]

In 1989, the DPRK and Iran issued a communiqué that referred to a joint commission for economic, scientific and technical cooperation, an indication of the warm relations between the two countries.[141] Bermudez and Carus suggest that Iran not only had an option to buy DPRK-produced SCUD-B missiles, but also agreed in 1985 to finance the North Korean program (see the chapter on Iran).

This latter arrangement illuminates two aspects of the DPRK-Iranian connection. First, it explains why the first combat-ready DPRK-produced missiles were apparently exported rather than deployed in the North itself.[142] Second, it accounts for the DPRK's willingness to absorb the high political costs of becoming Iran's major arms supplier. Iraq and other Arab states, where the North had nurtured a diplomatic advantage relative to the South, denounced the DPRK's opportunism. Chung-in Moon has argued that this episode marked the DPRK's metamorphosis from "a vanguard of radical ideology to a profit-seeking entrepreneur."[143]

In February 1992, US sources stated that a North Korean freighter was heading for Syria with an estimated US$100 million of missiles and other cargo in a second attempt to deliver the shipment. (An earlier shipment reportedly was abandoned in 1991 after it was identified publicly and Egypt barred the ship from entering the Suez Canal.) In the first week of March 1992, the Bush administration reportedly examined the military option of boarding two North Korean cargo ships heading for the Iranian Gulf port of Bandar Abbas, allegedly loaded with SCUD C missiles for Syria and Iran.[144]

In response, Iran warned the United States against interfering with ships destined for its ports. Israel threatened to prevent the shipment from arriving. An earlier threat led Pyongyang to recall a vessel in October 1990.[145] The *Dae Hung Ho* eluded US surveillance in the Gulf region by hugging the Iranian coast and docked in Iran in early March.[146] It remains unclear whether the United States lost track of the vessel, accepted that the ship was not carrying SCUD-B missiles, or concluded that it lacked authority to intercept the vessel.[147]

DPRK-Libyan Connection. In the first week of June, 1991, a ROK military source suggested that Libya had agreed to finance the development of a SCUD missile with a 1,000 km range. A few days later, however, the ROK Ministry of Defense denied that it ever suggested that Libya had such an arrangement with the DPRK and stated categorically that: "The South Korean Government has no knowledge of any military cooperation between Pyongyang and Tripoli."[148] In September 1991, an Egyptian paper reported again that the Libya had contracted with the DPRK to purchase missiles along with 300 SCUDs to be provided to Iran and 20 SCUDs to Syria.[149]

Disincentives to DPRK and ROK Missile Exports

The DPRK is an imprudent and reckless exporter of missile technology and weapons. It has not hesitated to supply missiles to states at war. Nor has it balked at selling missiles in conflict-ridden regions which were made more unstable by the diffusion of missiles. In contrast, the ROK has refrained from missile exports. It is useful to examine the factors which explain why the two Koreas have behaved so differently with respect to missile exports.

DPRK Disincentives

The DPRK has not halted marketing missiles in spite of at least seven disincentives that might be expected to persuade it to do so. These include:

Security Allies. The DPRK's allies have not constrained the DPRK. China used the DPRK for its own missile exports and refused to stop Pyongyang from exporting Chinese-supplied missiles. The former Soviet Union had little power (and sometimes little motivation due to its conflict with the United States) to stop the DPRK from exporting missiles during the Cold War.

Ideological Barriers. The DPRK has not allowed ideology to interfere with its missile exports. This is hardly surprising as the DPRK is the only state committed to Kim Il Sungism and his *chuche* philosophy.

Global Non-Proliferation Regimes. The DPRK is still not fully committed to the NPT nor to the supplier consensus represented by the participants in the MTCR.[150] The latter regime is led by its archenemy, the United States, a situation that does not encourage DPRK participation. In April 1992, however, while denying that the DPRK exports SSMs, Deputy Prime Minister and Foreign Minister Kim Yong Nam told a group of visiting Americans that the North is willing to observe the guidelines of the Missile Technology Control Regime. "Other countries have associated themselves with it," he stated, "Why not us?"[151]

External Sanctions. The DPRK is relatively invulnerable to the immediate effects of external political and economic sanctions. Being bankrupt, its economy exhibits low levels of external trade and financial flows. Being autarchic, it can continue to produce the minimal requirements for national survival and domestic political stability for years. Being repressive, it can ruthlessly and quickly dispose of emerging domestic unrest stimulated by economic shortages. Sanctions are not a credible threat to weaken the regime. Moreover, Pyongyang is acutely aware that Seoul does not want and cannot afford the DPRK to implode, imposing the costs of reunification on the South.

Domestic Public Opinion. Many political analysts deny that a domestic public opinion exists in the DPRK. They argue that the notion of a North Korean civil society that constrains the policies and actions of the leadership is a misnomer. Rather, the North Korean state pervades and dominates civil society to an extent unparalleled in the world.

Moreover, the North Korean elite—totaling perhaps 10,000 people of whom a couple of thousand are really important cogs in Kim Il Sung's machine—is divided and fragmented by a variety of control mechanisms. It is therefore incapable of stalling or even opposing the implementation of policies developed and dictated at the highest level of the extraordinarily centralized North Korean authority structure that culminates in the two Kims, father and son.

Regional Arms Control. In the absence of a regional security and arms control framework that includes the DPRK and its adversaries, the DPRK has few non-military means to reduce its perceived external security threats.

Rapprochement with the South. The DPRK has not shown itself to be enthusiastic about embracing the ROK in the short to medium term (before 2000). Indeed, the security elites of the two countries who fought during the civil war remain mortal enemies. The North let slip a series of opportunities in 1991–92 to accelerate the process of political-economic rapprochement with the South, including major trade and investment in the North led by the ROK and including Japan.

The crucial obstacle to north-south progress has been the alleged nuclear weapons program of the North at Yongbyon. It appears that the North has decided that major economic reforms needed to absorb external economic aid and investment would threaten the regime's survival.[152] Having elected to go slow on reunification, the North has little incentive to implement the nuclear safeguards accord and IAEA inspections. Seoul therefore has little marginal leverage over Pyongyang's activities, including its missile exports.

These seven possible disincentives, therefore, have failed to constrain the DPRK trade in missiles. What about the ROK?

ROK Disincentives

Three factors have dissuaded the ROK from entering the missile market to date. These are (1) the influence of the United States; (2) the ROK's desire to be perceived as a responsible member of the world community; and (3) the opportunity costs of a major missile program. The rest of this section analyses briefly each of these constraints.

Security Alliance. Until recently, the US-ROK security alliance has been the major disincentive to an active ROK missile program and exports. Whenever the ROK probed US resolve that it should not become missile-capable, the United States used its dominant status in the alliance to impose discipline on Seoul. The existence of a hegemonic ally to the ROK compares with the lack of one in the DPRK alliance relationships.

Global Regimes. The ROK leadership values greatly its reputation as a peaceful trading state committed to global and regional communities. Its membership and implementation of its NPT obligations have been exemplary since the mid-seventies, except for a few attempts to nibble at the margins by obtaining reprocessing technology.

The ROK will also observe the terms of the Missile Technology Control Regime when it comes to exporting any indigenously developed missiles or booster rockets. The major powers cannot expect the ROK to forego eventual development of its own missiles and booster rockets, however.

Opportunity Costs. Given the US military presence in the South, the ROK military has not had to offset DPRK missile capabilities with its own missiles. Rather, it has been able to rely on US-controlled missiles deployed in the ROK, or on US missiles transferred or sold to South Korea. The ROK military had—and still has—more important military priorities than investing scarce resources in major missile programs. This constraint will weaken as the ROK economy grows, and as civilian, dual-capable, aerospace capabilities are nurtured and as the US commitment seems to decline.

Conclusion

The North and South Korean states have very different policies about obtaining and exporting ballistic missiles. These diverging strategies could be described as vertical and horizontal, respectively. Isolated and largely left to its own devices, the North Korean state spent the last two decades producing and profiting from its own military missiles. It launched a frontal assault to surmount the lower rungs of the missile ladder.

In contrast, the South Koreans benefited from a security patron which deployed advanced missiles in and around Korea, relieving the ROK of any urgent military need to offset the DPRK's missile capabilities. Consequently, the ROK chose to position itself in crucial industrial and commercial segments of high technology sectors, including space and aerospace

industries. In the next decade, this strategy will enable the ROK to step sideways onto the missile ladder at a much higher level of capability than the DPRK. The Missile Technology Control Regime imposed by the major suppliers of missiles and booster rockets will have to deal with an indigenous ROK or unified Korean capability within a decade or less.

The motivations driving the DPRK to produce and export missiles are persistent. The incentives for the ROK to manufacture dual capable rocket technology and its disincentives to export missiles are equally enduring. It follows that integrating both Koreas into a global missile arms control regime will entail reduction in the basic insecurities that afflict the ROK and the DPRK. It will also require introducing missile-related issues into North-South arms control negotiations in Korea; regional security fora that address missile technology diffusion; and adjustments to the global MTCR that link regional missile control measures with global controls on missile research, development, testing, deployment, and trade.

A major outstanding issue is reunification. This essay has assumed that reunification will occur slowly (over one or two generations). The likely sequence of reunification is political-symbolic links; cultural and social exchange; economic and environmental joint activities; political-institutional integration; and only lastly, military reunification.

If reunification should be rapid, non-violent (that is, without a north-south war whatever the mode of succession or transformation of the North), and soon, then a new missile power in Asia could emerge very quickly. This outcome would result from the fusion of the DPRK's capability to manufacture military missiles and its expertise, and marketing networks on the one hand with the ROK's military and industrial technology and investment resources on the other.

Whether separate or fused, Korean missile programs make it urgent to develop regional and global frameworks for missile non-proliferation which offer new incentives to forego missile development, deployment, and trade. A regional nuclear free zone and/or a global or regional ballistic missile test free zone are two such frameworks that bear investigation. Both, however, are beyond the scope of this essay.

Notes

1. Nautilus Pacific Research, 746 Ensenada Ave, Berkeley, CA 94707, USA. tel: 1 510 5269295; fax 1 510 5269297. Des Ball, Seth Carus, Andrew Mack, Janne Nolan, William Potter, and Sandy Spector generously shared information used in this study. Nautilus researchers Megan van Frank provided research assistance; Lyuba Zarsky and an anonymous reviewer critical comments; and Cassandra Morrow production support. Korean (North and South), American, and Australian officials graciously granted interviews that are drawn upon in this essay. Finally, the author acknowledges funding of Nautilus' on-going work on missile and nuclear proliferation from the Alton Jones, Fund for Tomorrow, Merck, and Ploughshares foundations; and organizational support from the Nautilus Board of Directors.

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